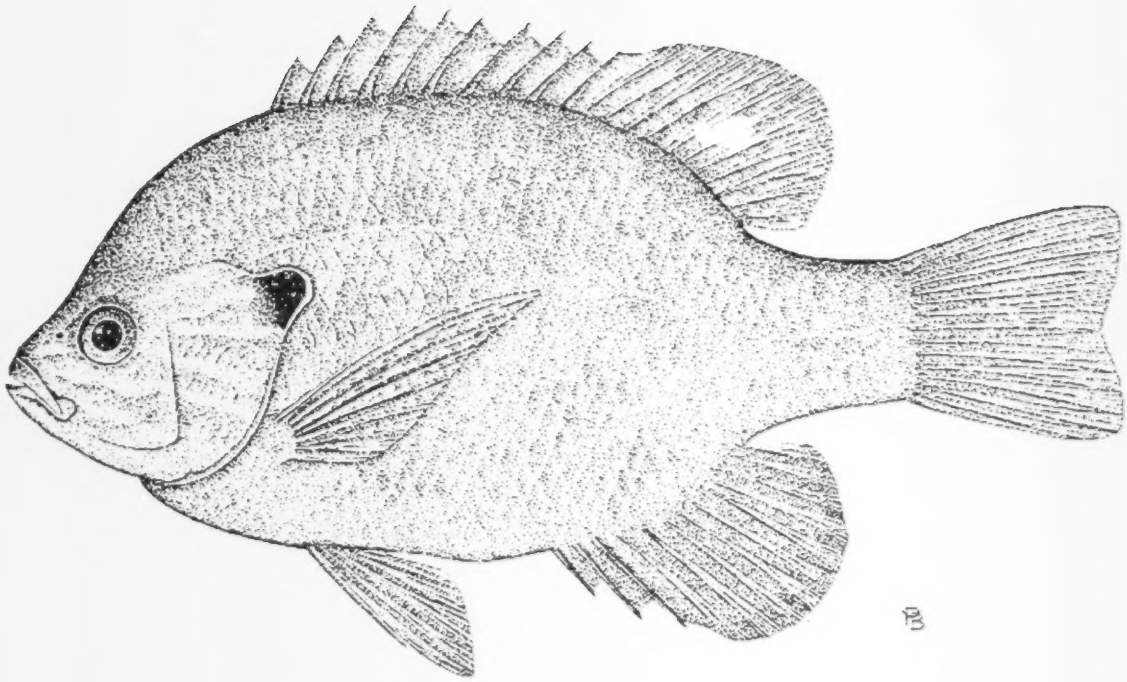
Puslinch Lake Fisheries Assessment 2001 and 2002



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ABSTRACT

Hoop nets were used in the summer of 2001 and 2002 to assess the fish community of Puslinch Lake near Cambridge, Ontario. Catch per unit effort (CPUE) and relative abundance of each species were calculated. Sunfish were the most abundant species captured followed by black crappie, brown bullhead, northern pike and walleye. Largemouth bass, smallmouth bass, yellow perch, white suckers and rock bass were also captured.

Length data and age data collected from scales and cleithra indicated that most species including northern pike and walleye were reproducing successfully in the lake.

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INTRODUCTION

In recent decades, an increase in the thickness of organic sediments, seasonal algal blooms, extensive macrophyte growth and periodic fish kills have resulted in a greatly reduced enjoyment of recreational activities on Puslinch Lake. These changes are the result of eutrophication which is a natural process in all lakes. In Puslinch Lake, this process has been greatly accelerated by human activity. Recently, there has been an interest in improving the recreational quality of the lake. This has resulted in the identification of a number of rehabilitation options, some of which propose significant changes to the environment of the lake.

A previous study (Bonter et. al., 2000) assessed the fish habitat of Puslinch Lake to assist in evaluating the proposed rehabilitation options. The purpose of the present study was to describe the fish community of the lake prior to significant rehabilitation efforts.

PUSLINCH LAKE

Puslinch Lake has the distinction of being the largest natural body of water in Southwestern Ontario, excluding the Great Lakes. It is located in Wellington County just northeast of the City of Cambridge (Figure 1). The surface area of the lake is approximately 156 ha, with a water volume of 2.27×10^6 m^3 and a mean depth of 1.4 m. The lake measures 2.012 km by .805 km. There are five islands, the biggest of which measures 2.4ha. (Figure 2). There are a few shoals and one main deep area located off McCormick's Point. The fish habitat of the lake including bathymetry, aquatic vegetation, substrate and fish spawning areas is described in Bonter et. al. (2000).

METHODS

Nearshore Community Index Netting (HSCIN) Program

The Fisheries Assessment Unit network of the Ministry of Natural Resources developed the Nearshore Community Index Netting (HSCIN) program to assess the abundance and biological attributes (length, weight, and age) of warm water fish species that inhabit the nearshore zone of Ontario lakes during the summer and early fall (Willox and Lester, 1994). NSCIN is a standardized program that attempts to control for gear

selectivity, site selection bias, and seasonal and spatial variation in species distribution. When standardized equipment and techniques are used, more accurate analyses and comparisons can be made of trend-through-time data for individual lakes and among lakes across the province.

The key guidelines developed for the NSCIN program include: gear type (standard six-foot trapnets), sampling season (from August 1st until surface water temperature falls to 13° C), set duration (24 hours), and site selection (random, with no repeats). A more detailed description of standard sampling protocols is found in the NSCIN Manual of Instructions (Stirling, 1999).

Ideally, NSCIN would have been used to assess the fish community of Puslinch Lake. However, due to the shallow nature of the lake and its predominantly soft substrates, a modification of the NSCIN program was used. Trapnets could not be used and even hoop nets could be fished at only a few locations. Suitable sites were fished repeatedly with hoop nets.

Hoop Net Effort

Hoop nets required sites with a hard bottom and at least 1.2 m of water that were at least 24.4 m from shore. Due to the shallow nature of the lake and its predominantly soft substrates, few sites were suitable for hoop nets.

In 2001 and 2002, a total of 25 net sets were made at 6 sites with hoop nets to assess the fish community of Puslinch Lake. Between August 13th and August 23rd, 2001, 13 hoop nets were set at 6 sites (Table 1) and retrieved the next day. From 1 to 5 nets were set at each site. Site 26 was a suitable site for a hoop net and with such a limited number of other suitable sites, this site was used 5 times (although different areas of the same site – moving the net 15 – 20 metres up or down the shore each time). Site 32 was used once only because the landowner became upset about setting the net off the property. Site 11 was also a suitable site for a hoop net.

In 2002, hoop nets were set at the four most productive sites netted in 2001. Between August 12th and August 22nd, 2002, 12 hoop nets were set at 4 sites (Table 1) and retrieved the next day. Netting locations are indicated in Figure 2 and a description of the netting locations is found in Table 2.

Hoop net specifications are found in Appendix A.

Data Collection

Data collected at each net set included water and air temperatures, setting and retrieving times for the net, set location using GPS, lengths (mm), weight (g) and scale sample of all fish captured (except for brown bullhead *Ameiurus nebulosus*, northern pike *Esox lucius* and white sucker *Catostomus commersoni*). In 2001 total lengths and fork lengths were taken for northern pike; only fork lengths were taken for all other species. In 2002 both total lengths and fork lengths were taken for all species. In 2001, weights of northern pike, walleye *Stizostedion vitreum*, largemouth bass *Micropterus salmoides* and white suckers were determined using spring scales to the nearest 5 g and weights of the other species were determined with a digital scale to the nearest 1 g. Due to a digital scale malfunction in 2001 weights of these other species were not taken until August 16. Cleithra were taken from a sample of the northern pike for accurate aging. In 2002, all weights were determined with a digital scale.

In 2001, all captured fished were marked with a fin clip prior to release in an attempt to estimate population size using mark-recapture techniques.

The genus *Lepomis* of the family Centrarchidae has been known to hybridize frequently in nature. In 2001 attempts were made to differentiate between pumpkinseed *Lepomis gibbosus*, bluegill *Lepomis macrochirus* and their hybrids. The degree of hybridization between these two species is so great and the range of characters so confusing that it is almost impossible to separate hybrids from backcrosses with parental species, or even to designate pure parental forms (Scott and Crossman, 1973). In 2002, no attempt was made to differentiate members of this group and fish in this group was simply called "sunfish".

Scale samples from walleye and largemouth bass and cleithra samples from northern pike were aged at the Ontario Federation of Anglers and Hunters fish aging laboratory.

Data Analysis

In order to make valid comparisons between 2001 and 2002, only data collected from the four common sites was used in the analysis. Because of year to year variation, the data from 2001 and 2002 was also weighted and pooled to generate more accurate average estimates. The data can be used to determine the *relative* abundance of various species and growth rates of species. If repeated in the future, surveys conducted using the same methods can be used to determine if species are eliminated or drastically reduced or enhanced as a result of rehabilitation activities.

RESULTS AND DISCUSSION

General

Future collections using the same methodology can be used to provide information on year class strength and length/weight at age and can also be used to detect major changes in fish community composition as a result of changes to fish habitat in the lake or due to other factors. This may not be 100% accurate (due to the sampling bias of the gear) however, this bias should be consistent year after year if the same gear and technique is used. It must be remembered that periodic fish kills in both summer and winter have been documented as far back as the winter of 1953 and as recently as 1992 (Coulson, in prep.). Some of these fish kills were quite significant and would be expected to result in significant adjustments to the fish community in the lake.

Previous studies (Bonter et. al. 2000) have shown that there is a potentially large number of largemouth bass in the lake. It is believed that in Puslinch Lake, largemouth bass occupy habitat that is densely covered in weeds and has a shallow depth (less than 1.2m). Hoop nests were not able to sample those habitats and therefore largemouth bass may be under-represented in this study.

Population Estimates

In 2001, all captured fished were marked with a fin clip prior to release in an attempt to estimate population size using the mark-recapture technique. For the reasons outlined below, the data could not be used to estimate population size:

1) Sites could not be selected randomly. The topography of the lake, its small size and the shallow depth of water dictated that only certain sites could be sampled. Because nets were not set randomly and sites were used repeatedly, there can be no confidence in the population estimates.
2) Even though sites were sampled on consecutive nights – there were very few recaptures. The low number of recaptured fish also decreases confidence in any population estimate. The low number of recaptures may have been influenced by the large number of fish removed for contaminant sampling.

Catch Per Unit Effort (CPUE)

For this study one unit of fishing effort is one hoop net set in a 24-hour period. Catch per unit of fishing effort, CPUE, is a used as measure of relative abundance or density of fish in a waterbody. CPUE for both 2001 and 2002 are presented in Table 3. CPUE varied considerably among the sites in both years. As indicated above, the gear may be biased against largemouth bass. Weighted mean CPUE using only data from the four sites sampled in both years is presented in Table 4. These weighted mean CPUE for most species were surprisingly similar between 2001 and 2002. The exception was sunfish which were the most numerous species in the lake. Weighted and pooled CPUE for 2001 and 2002 are also presented in Table 4.

Relative Abundance

The relative abundance of each species has been expressed as a percentage of the entire catch. The unweighted relative abundance of species for each year is presented in Table 5. The unweighted mean relative abundances are similar between years and the order of dominance of the most abundant species was the same between years, i.e sunfish > black crappie > brown bullhead > northern pike > walleye > largemouth bass. As indicated above, the gear may be biased against largemouth bass. Weighted mean relative abundance using only data from the four sites sampled in both years is presented in Table 6. Weighted and pooled relative abundance for 2001 and 2002 are also presented in Table 6.

Biological Data

Sunfish

In 2001 when an attempt was made to distinguish between bluegill and pumpkinseed, 65.3% were obvious bluegill, 12.8% were obvious pumpkinseed and 21.9% were presumed to be hybrids. Prior to 2001, all "sunfish" captured or observed were presumed to have been pumpkinseed (Bonter et. al. 2000).

Mean fork lengths and weights of sunfish for both 2001 and 2002 and pooled data from both years are presented in Table 7. Mean fork lengths and weights between the two years are very similar.

Scale samples were taken from 535 sunfish and these are stored at the Ministry of Natural Resources office in Guelph.

Black Crappie

It is unknown if the existing black crappie population is natural or the result of stocking. It is known that sixteen 15 – 18 cm long black crappie were released into the lake in 1957. Mean fork lengths and weights of black crappie for both 2001 and 2002 and pooled data from both years are presented in Table 7. Mean fork lengths and weights were lower in 2002 than in 2001.

Scale samples were taken from 131 black crappie and these are stored at the Ministry of Natural Resources office in Guelph.

Brown Bullhead

Mean fork lengths and weights of brown bullhead for both 2001 and 2002 and pooled data from both years are presented in Table 7. Mean fork lengths and weights between the two years are very similar.

Northern Pike

The northern pike population in Puslinch Lake is thought to be the result of an inadvertent introduction in the 1950's (Hans et al. 1981). The introduction of pike was thought to have led to a decline in the populations of both walleye and bass in the 1950's.

A total of 37 (65%) of the 57 northern pike captured in the two year study were aged from cleithra. The northern pike population in Puslinch Lake is made up of at least seven age classes (Table 8). Northern pike have reproduced every year between 1993 and 2000. A 759 mm/2.2 kg specimen captured in 2002 suggests reproduction prior to 1993. Sample sizes are too small to comment on the strength of the various year classes. Gear selectivity may also be a factor here.

Northern pike length and weight at age data is presented in Table 9. Extreme caution should be used in interpreting the data because of the small sample sizes. Female pike are known to grow faster than male pike, especially in the south part of this specie's range (Scott and Crossman, 1973) and this may be the cause of the wide range in lengths at age seen in the data. The mean weight of all aged fish (1073 g) was less than the mean weight of all fish sampled (1162 g) suggesting that the sample may not have been representative.

Walleye

The walleye population in Puslinch Lake is considered to be an introduced population. Walleye were released into the lake as early as the late 1940's (Hans et al. 1981). Between 1979 and 1981 adult walleye from the lower Grand River at Dunnville were released into the lake. A fisheries assessment conducted by the OMNR in 1987 (Halyk 1987) indicated there was some natural reproduction of walleye occurring in the lake at that time. Most recently, the Puslinch Lake Conservation Association stocked young-of-the-year walleye (approx. 5 months old) from a private walleye culture facility in eastern Ontario between 1997 and 1999. In 1997 and 1998, and estimated 1000 walleye 4.5" – 9.5" (11 - 24 cm) long were stocked each year and in 1999 and estimated 661 walleye 3.5" – 8" (9 – 20 cm) long were stocked.

A total of 45 (96%) of the 47 walleye captured in the two year study were aged from scale samples. The walleye population in Puslinch Lake is made up of at least seven age classes (Table 10). The data indicate that there is some natural reproduction of walleye in the lake as walleye from every age-class between 1992 and 1996, except the 1993 age-class were captured. Walleye from the 1997, 1998 and 1999 age-classes were either naturally reproduced fish or the result of fish stocked by the Puslinch Lake

Conservation Association during those years. Sample sizes are too small to comment on the strength of the various year classes. Gear selectivity may also be a factor here.

Walleye length and weight at age data is presented in Table 11. Extreme caution should be used in interpreting the data because of the small sample sizes. Female walleye are known to grow faster than male walleye (Scott and Crossman, 1973) and this may be the cause of the wide range in lengths at age seen in the data. The length-weight regression for Puslinch Lake walleye (excluding obviously erroneous data) was: Weight (g) = - 2417.2579 + 7.4929 x Fork Length ($p<0.0001$, $r^2 = 0.9193$) (Chris Robinson, Ontario Federation of Anglers and Hunters, pers. comm.).

Largemouth Bass

All of the 24 largemouth bass captured in the two year study were aged from scale samples. The largemouth bass population in Puslinch Lake is made up of at least nine age classes (Table 12). Largemouth bass from all age classes between 1989 and 2001 were captured except the years 1991, 1997, 1999 and 2000. Sample sizes are too small to comment on the strength of the various year classes. Gear selectivity may also be a factor here.

Largemouth bass length and weight at age data are also presented in Table 12. Extreme caution should be used in interpreting the data because of the small sample sizes.

Smallmouth Bass

Smallmouth bass were stocked by the Department of Lands and Forests between 1947 and 1964 are now considered to be rare in the lake. Only one was captured in 2002 and none in 2001.

Yellow Perch

Mean fork lengths and weights of yellow perch from both years are presented in Table 13. The size range of individuals captured suggests that this species is not reproducing well in the lake.

Scale samples were taken from 11 yellow perch and these are stored at the Ministry of Natural Resources office in Guelph.

White Sucker

Mean fork lengths and weights of white sucker from both years are presented in Table 13. All individuals of this species were large suggesting that this species may not be reproducing well in the lake.

Rock Bass

Mean fork lengths and weights of rock bass from both years are presented in Table 13. Scale samples were taken from 3 rock bass and these are stored at the Ministry of Natural Resources office in Guelph

RECOMMENDATIONS

To assess the effect of rehabilitation efforts on the relative abundance, growth rates and reproduction of fish in Puslinch Lake, fisheries assessments using methods identical to those described above should be repeated several years after significant rehabilitation efforts have taken place. All future assessment efforts should be conducted for four nights in mid-August with equal net sets at sites 10, 26, 27 and 29 only. For comparison purposes, biological data (lengths, weights, scales, cleithra) should be collected using the same methods as in this study.

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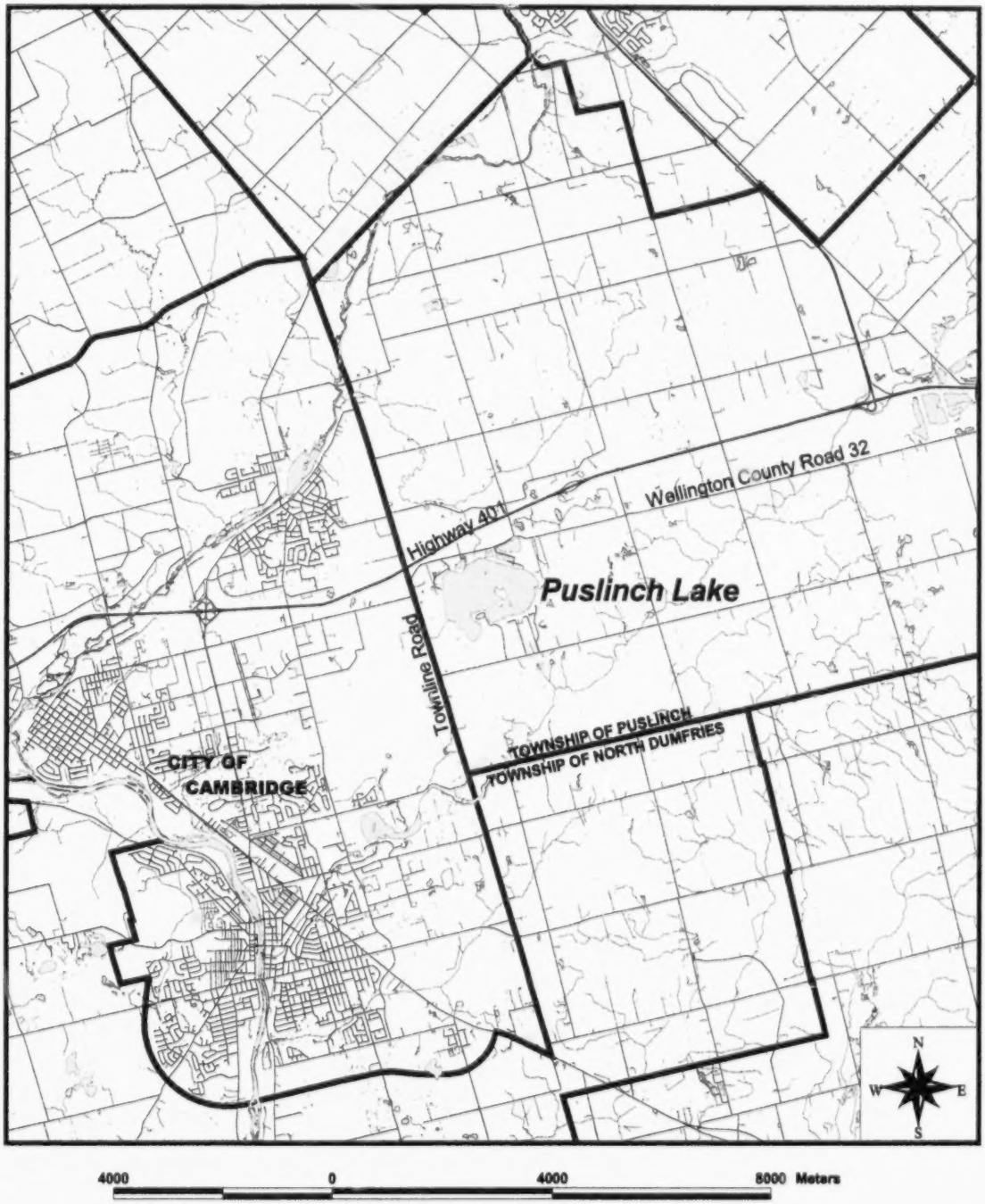


Figure 1: Puslinch Lake

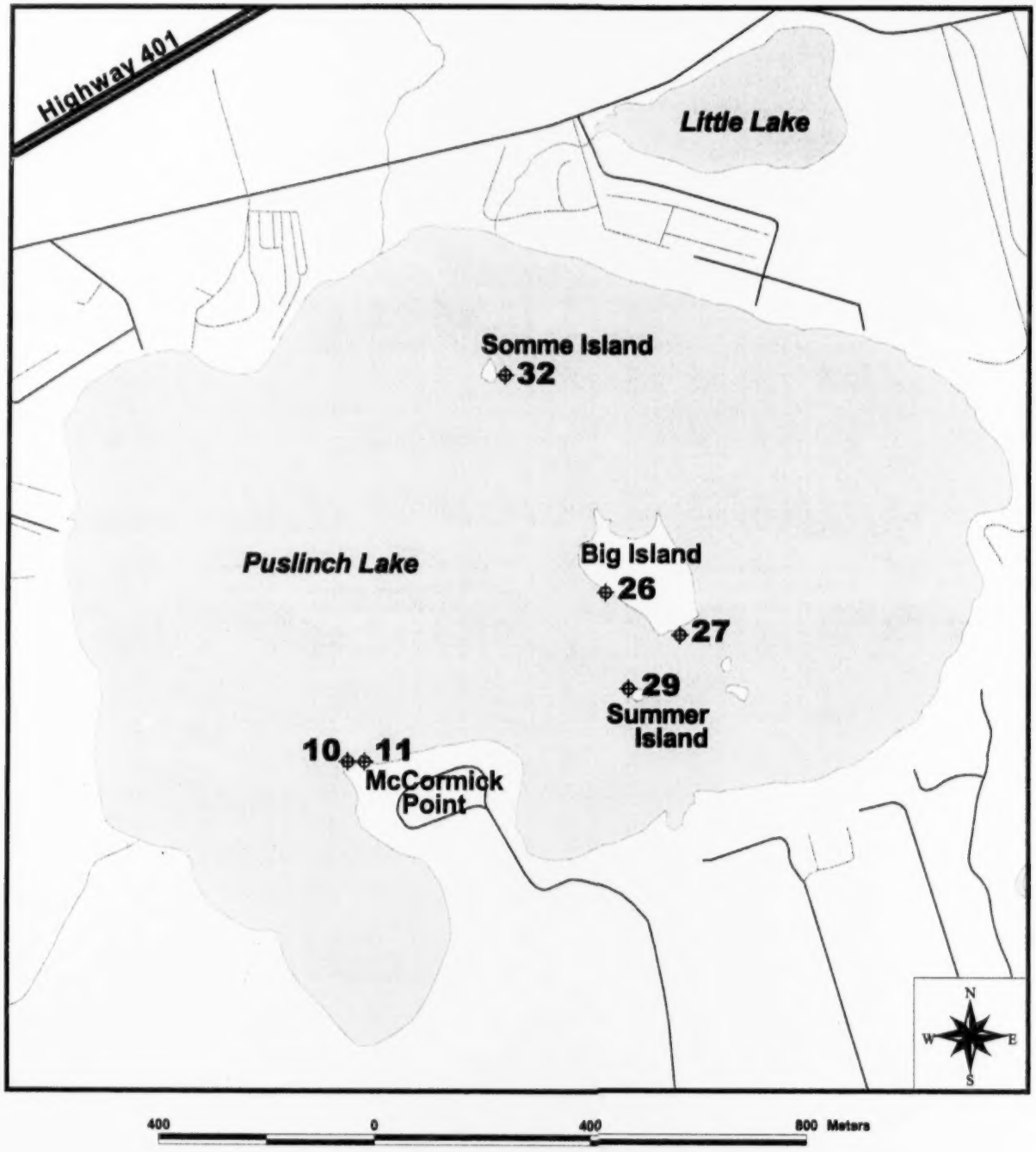


Figure 2: Hoop Netting Sites, Puslinch Lake Fisheries Assessment, 2001 and 2002.

Table 1. Hoop Net Sets, Puslinch Lake, 2001 and 2002

2001			2002		
Site	Date Set	Date Retrieved	Site	Date Set	Date Retrieved
10	Aug. 13	Aug. 14	26	Aug. 12	Aug. 13
26	Aug. 14	Aug. 15	10	Aug. 12	Aug. 13
32	Aug. 14	Aug. 15	27	Aug. 13	Aug. 14
27	Aug. 15	Aug. 16	29	Aug. 13	Aug. 14
11	Aug. 15	Aug. 16	26	Aug. 14	Aug. 15
26	Aug. 16	Aug. 17	29	Aug. 14	Aug. 15
10	Aug. 16	Aug. 17	27	Aug. 15	Aug. 16
26	Aug. 20	Aug. 21	29	Aug. 15	Aug. 16
29	Aug. 20	Aug. 21	10	Aug. 20	Aug. 21
26	Aug. 21	Aug. 22	27	Aug. 20	Aug. 21
29	Aug. 21	Aug. 22	27	Aug. 21	Aug. 22
26	Aug. 22	Aug. 23	29	Aug. 21	Aug. 22
29	Aug. 22	Aug. 23			
Totals			**Totals**		
Site	# of Sets		Site	# of Sets	
10	2		10	2	
11	1		26	2	
26	5		27	4	
27	1		29	4	
29	3				
32	1				
Total	13		Total	12	

Table 2. GPS Coordinates and Locations of Hoop Net Sites in Puslinch Lake, 2001 and 2002

Site	GPS Coordinates	Location
10	GPS: 55 92 20E; 48 06 997N	west side of McCormick Point
11	GPS: 55 92 51E; 48 06 997N	north side of McCormick Point
26	GPS: 55 96 97E; 48 07 312N	southwest side of Big Island
27	GPS: 55 98 36E; 48 07 233N	southeast side of Big Island
29	GPS: 55 97 40E; 48 07 133N	Summer Island
32	GPS: 55 95 08E; 48 07 716N	east side of Somme Island

Table 3. Catch-Per-Unit-Effort (CUE) For Hoop Nets in Puslinch Lake, 2001 and 2002

	CUE (2001)						
Species	Site 10 n = 2	Site 11 n = 1	Site 26 n = 5	Site 27 n = 1	Site 29 n = 3	Site 32 n = 1	Unweighted Mean
Sunfish	11.0	11.0	42.0	37.0	21.7	26.0	28.8
Black Crappie	10.0	17.0	3.8	10.0	3.7	8.0	6.5
Brown Bullhead	10.0	0.0	1.2	5.0	0.0	1.0	2.5
Northern Pike	2.0	3.0	2.2	0.0	3.0	5.0	2.5
Walleye	1.0	2.0	2.4	1.0	3.0	2.0	2.2
Largemouth Bass	1.0	0.0	1.2	2.0	0.3	1.0	0.9
Smallmouth Bass	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Yellow Perch	0.5	0.0	0.2	4.0	0.0	1.0	0.5
White Sucker	0.0	0.0	0.8	1.0	0.3	0.0	0.5
Rock Bass	0.0	0.0	0.4	0.0	0.0	0.0	0.2
Golden Shiner	0.0	0.0	0.0	0.0	0.3	0.0	0.1

	CUE (2002)				
Species	Site 10 n =2	Site 26 n= 2	Site 27 n = 4	Site 29 n = 4	Unweighted Mean
Sunfish	19.5	21.0	126.0	34.5	60.25
Black Crappie	3.0	1.5	7.0	9.0	6.08
Brown Bullhead	2.5	3.5	1.3	12.0	5.42
Northern Pike	2.0	1.0	2.5	2.0	2.0
Walleye	4.0	0.5	0.75	1.75	1.58
Largemouth Bass	0.5	1.0	1.5	0.75	1.0
Smallmouth Bass	0.0	0.0	0.25	0.0	0.08
Yellow Perch	0.5	0.5	0.0	0.5	0.33
White Sucker	0.0	0.5	0.5	0.5	0.42
Rock Bass	0.0	0.0	0.25	0.0	0.08
Golden Shiner	0.0	0.0	0.0	0.0	0.0

* Sunfish includes bluegill, pumpkinseed and their hybrids
* Includes # sampled plus damaged fish plus escaped fish plus recaptured

Table 4. Weighted and Pooled Catch-Per-Unit-Effort (CUE) For Hoop Nets in Puslinch Lake, 2001 and 2002.

	CUE (2001) - Weighted Data					CUE (2002) - Weighted Data				
Species	Site 10 n = 3	Site 26 n = 3	Site 27 n = 3	Site 29 n = 3	Weighted CUE	Site 10 n =3	Site 26 n= 3	Site 27 n = 3	Site 29 n = 3	Weighted CUE
Sunfish	16.5	25.0	111.0	21.7	28.4	30	31.5	95.0	26	50.3
Black Crappie	15.0	2.3	30.0	3.7	6.9	4.5	2.3	5.0	6.8	5.13
Brown Bullhead	15.0	0.7	15.0	0.0	4.05	4	5	10	9.0	4.83
Northern Pike	3.0	1.3	0.0	3.0	1.8	3.0	1.5	2	1.5	1.89
Walleye	1.5	1.5	3.0	3.0	1.85	6.0	0.75	0.6	1.3	1.76
Largemouth Bass	1.5	0.7	6.0	0.3	1.13	0.75	1.5	1.1	0.6	0.94
Smallmouth Bass	0.0	0.0	0.0	0.0	0	0.0	0.0	0.2	0.0	0.08
Yellow Perch	0.75	0.1	12.0	0.0	1.18	0.75	0.75	0.0	0.4	0.38
White Sucker	0.0	0.5	3.0	0.3	0.54	0.0	0.75	0.4	0.4	0.38
Rock Bass	0.0	0.25	6.0	0.0	0.1	0.0	0.0	0.2	0.0	0.08
Golden Shiner	0.0	0.0	0.0	0.3	0.08	0.0	0.0	0.0	0.0	0

	CUE (2001 and 2002) - Pooled & Weighted Data				
Species	Site 10 n = 3	Site 26 n = 3	Site 27 n = 3	Site 29 n = 3	Pooled CUE
Sunfish	23.3	28	103	24	39.35
Black Crappie	10	2.3	17.5	70	6
Brown Bullhead	10	2.8	12.5	4.5	4.44
Northern Pike	3	1.4	1	2.3	1.84
Walleye	3.8	1.2	1.8	1.5	1.8
Largemouth Bass	1.2	1.1	3.5	0.45	1
Smallmouth Bass	0	0	0.1	0	0.04
Yellow Perch	0.75	0.4	6	0.2	0.78
White Sucker	0	0.6	1.7	0.35	0.46
Rock Bass	0	0.12	3.1	0	0.09
Golden Shiner	0	0	0	0.15	0.04

* Sunfish includes bluegill, pumpkinseed and their hybrids
* Includes # sampled plus damaged fish plus escaped fish plus recaptured

Table 5. Relative Abundance of Fish Species From Hoop Nets in Puslinch Lake, 2001 and 2002

	Relative Abundance (2001)							
Species	Site 10 n = 2	Site 11 n = 1	Site 26 n = 5	Site 27 n = 1	Site 29 n = 3	Site 32 n = 1	Total n = 13	Percent
Sunfish	22	13	210	39	65	26	375	64.54%
Black Crappie	20	17	19	10	11	8	85	14.63%
Brown Bullhead	20	0	6	5	0	1	32	5.51%
Northern Pike	4	3	11	0	9	6	33	5.68%
Walleye	2	2	12	1	9	2	28	4.82%
Largemouth Bass	2	0	6	2	1	1	12	2.07%
Smallmouth Bass	0	0	0	0	0	0	0	0.00%
Yellow Perch	1	0	1	4	0	1	7	1.20%
White Sucker	0	0	4	1	1	0	6	1.03%
Rock Bass	0	0	2	0	0	0	2	0.34%
Golden Shiner	0	0	0	0	1	0	1	0.17%
Total							581	100.00%

	Relative Abundance (2002)					
Species	Site 10 n = 2	Site 26 n = 2	Site 27 n = 4	Site 29 n = 4	Total n = 12	Percent
Sunfish	39	42	504	138	723	77.99%
Black Crappie	6	3	28	36	73	7.87%
Brown Bullhead	5	7	5	48	65	7.01%
Northern Pike	4	2	10	8	24	2.59%
Walleye	8	1	3	7	19	2.05%
Largemouth Bass	1	2	6	3	12	1.29%
Smallmouth Bass	0	0	1	0	1	0.11%
Yellow Perch	1	1	0	2	4	0.43%
White Sucker	0	1	2	2	5	0.54%
Rock Bass	0	0	1	0	1	0.11%
Golden Shiner	0	0	0	0	0	0.00%
Total					927	100.00%

* Includes # sampled plus damaged fish plus escaped fish plus recaptured

* Sunfish includes bluegill, pumpkinseed and their hybrids

Table 6. Weighted and Pooled Relative Abundance of Fish Species From Hoop Nets in Puslinch Lake, 2001 and 2002

	Relative Abundance (2001) - Weighted Data						Relative Abundance (2002) - Weighted Data					
Species	Site 10 n = 3	Site 26 n = 3	Site 27 n = 3	Site 28 n = 3	Total n = 12	Percent %	Site 10 n = 3	Site 26 n = 3	Site n = 3	Site 28 n = 3	Total n = 12	Percent %
Sunfish	33	126	117	65	341	61.74%	58.5	63	378	104	603.5	76.50%
Black Crappie	30	11.5	30	11	82.5	14.94%	9	4.5	21	27	61.5	7.80%
Brown Bullhead	30	3.6	15	0	48.6	8.80%	7.5	10.5	4	36	58	7.35%
Northern Pike	6	6.6	0	9	21.6	3.91%	6	3	7.5	6	22.5	2.85%
Walleye	3	7.2	3	9	22.2	4.02%	12	1.5	2.3	5.3	21.1	2.67%
Largemouth Bass	3	3.6	6	1	13.6	2.46%	1.5	3	4.5	2.3	11.3	1.43%
Smallmouth Bass	0	0	0	0	0	0.00%	0	0	1	0	1	0.13%
Yellow Perch	1.5	0.6	12	0	14.1	2.55%	1.5	1.5	0	1.5	4.5	0.57%
White Sucker	0	2.5	3	1	6.5	1.18%	0	1.5	1.5	1.5	4.5	0.57%
Rock Bass	0	1.2	0	0	1.2	0.22%	0	0	1	0	1	0.13%
Golden Shiner	0	0	0	1	1	0.18%	0	0	0	0	0	0.00%
Total					552.3	100.00%					788.9	100.00%

	Relative Abundance (2001 and 2002) - Weighted & Pooled Data					
Species	Spot 10 n = 3	Spot 26 n = 3	Spot 27 n = 3	Spot 28 n = 3	Total n = 12	Percent %
Sunfish	45.75	94.5	247.5	84.5	472.25	70.61%
Black Crappie	19.5	8	25.5	19	72	10.76%
Brown Bullhead	18.8	7	9.5	18	53.3	7.97%
Northern Pike	6	4.5	3.5	7.5	21.5	3.21%
Walleye	7.5	4.4	2.5	7	21.4	3.20%
Largemouth Bass	2.3	3	5	1.5	11.8	1.76%
Smallmouth Bass	0	0	0.5	0	0.5	0.07%
Yellow Perch	1.5	1	6	0.5	9	1.35%
White Sucker	0	2	2	1.5	5.5	0.82%
Rock Bass	0	0.6	0.5	0	1.1	0.16%
Golden Shiner	0	0	0	0.5	0.5	0.07%
Total					668.85	100.00%

* The above data are weighted calculations based on the orginal data
* Sunfish includes bluegill, pumpkinseed and their hybirds
* Includes # sampled plus damaged fish plus escaped fish plus recaptured

Table 7. Mean Lengths and Weights of Sunfish, Black Crappie and Brown Bullhead From Hoop Nets in Puslinch Lake 2001 and 2002

	Sunfish	Black Crappie	Brown Bullhead
Length			
2001			
Sample Size	319	64	32
Mean Fork Length (mm)	127.7	159.8	242.1
Mode	105	177	240
Median	126	169	245
Standard Deviation	22.4	31.6	23.2
2002			
Sample Size	506	57	66
Mean Fork Length (mm)	128.1	141.98	247.4
Mode	125	109	232
Median	124	138	246.5
Standard Deviation	21.4	33.98	13.14
2001 & 2002 Pooled			
Sample Size	825	121	98
Mean Fork Length (mm)	127.96	154.9	246.2
Mode	125	128	255
Median	105	154	245
Standard Deviation	21.8	33.5	17.1
Weight			
2001			
Sample Size	206	46	8
Mean Weight (g)	48.6	73.5	187.3
Mode	20	24	
Median	45	76.5	170.5
Standard Deviation	26.2	39.1	70
2002			
Sample Size	506	63	66
Mean Weight (g)	45.9	55.1	179.2
Mode	21	39	156
Median	37	39	178
Standard Deviation	27.2	42.7	45.1
2001 & 2002 Pooled			
Sample Size	712	109	74
Mean Weight (g)	46.7	62.8	180.1
Mode	20	24	156
Median	38	45	178
Standard Deviation	26.9	42.1	47.8

Table 8. Northern Pike Year Class Strength, Puslinch Lake, 2001 and 2002

2001

Year Class	1993	1994	1995	1996	1997	1998	1999	All
Age	8+	7+	6+	5+	4+	3+	2+	
N	2	1	2	6	4	3	1	19
Mean Total Length	590	612	649	635	594	457	476	

2002

Year Class	1994	1995	1996	1997	1998	1999	2000	All
Age	8+	7+	6+	5+	4+	3+	2+	
N	1	2	3	5	2	2	3	18
Mean Total Length	552	660	618	626	547	478	454	

Table 9. Northern Pike Length and Weight at Age, Puslinch Lake, 2001 and 2002

Age	2+	3+	4+	5+	6+	7+	8+	All
N	4	5	6	11	5	3	3	37
Mean Total Length (mm)	460	465	578	631	630	644	577	578
Minimum Total Length (mm)	389	426	535	493	582	612	543	389
Maximum Total Length (mm)	506	492	634	710	711	676	636	711
Mean Weight (g)	593	527	975	1408	1404	1272	845	1073
Minimum Weight (g)	361	425	755	638	957	100	567	361
Maximum Weight (g)	771	625	1250	1968	2250	1534	1125	2250

Table 10. Walleye Year Class Strength, Puslinch Lake, 2001 and 2002

2001

Year Class	1992	1993	1994	1995	1996	1997	1998		All
Age	9 +	8 +	7+	6+	5+	4+	3+		
N	1	0	5	3	4	10	5		28
Mean Fork Length (mm)	523		543	554	494	431	407		
Mean Weight (g)	1250		1600	1839	1125	1199	680		

2002

Year Class	1992	1993	1994	1995	1996	1997	1998	1999	All
Age	10+	9+	8+	7+	6+	5+	4+	3+	
N	0	0	2	2	1	1	8	3	17
Mean Fork Length (mm)			621	559	456	455	428	413	
Mean Weight (g)			2359	1911	925	1101	728	661	

Table 11. Walleye Length and Weight at Age, Puslinch Lake, 2001 and 2002

Age	3 +	4 +	5 +	6+	7+	8+	9+	All
N	8	18	5	4	7	2	1	45
Mean Fork Length (mm)	410	432	486	529	547	621	523	471
Minimum Forkl Length (mm)	374	265	455	456	459	580	523	
Maximum Fork Length (mm)	431	468	512	596	580	662	523	
Mean Weight (g)	673	990	1120	1610	1689	2359	1250	1178
Minimum Weight (g)	500	612	1050	925	800	2167	1250	
Maximum Weight (g)	800	1250	1250	2200	2000	2550	1250	

Table 12. Largemouth Bass Year Class Strength and Length and Weight at Age, Puslinch Lake, 2001 and 2002.

2001

Year Class	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	All
Age	12+	11+	10+	9 +	8 +	7+	6+	5+	4+	3+	2+	1+	
N	0	1	0	1	3	4	2	1	0	0	0	0	12

2002

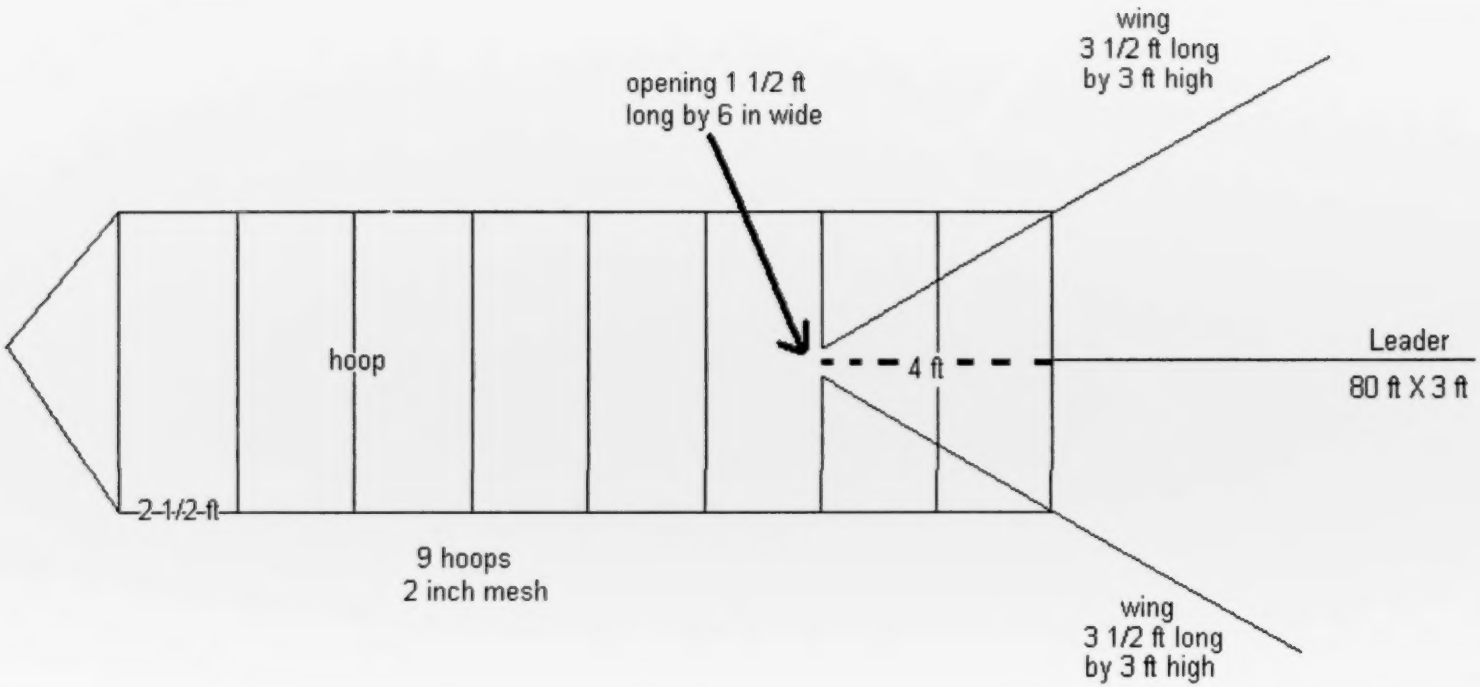
Year Class	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	All
Age	13+	12+	11+	10+	9+	8+	7+	6+	5+	4+	3+	2+	1+	
N	1	0	0	1	1	1	0	2	0	2	0	0	4	12

Age	13+	12+	11+	10+	9+	8+	7+	6+	5+	4+	3+	2+	1+	
N (2001 & 2002)	1	0	1	1	2	4	4	4	1	2	0	0	4	24
Mean Fork Length (mm)	443		381	424	408	395	367	317	274	318			156	330
Mean Weight (g)	999		1100	1202	1165	1073	918	533	325	498			52	698

Table 13. Mean Lengths and Weights of Yellow Perch, White Sucker and Rock Bass, Puslinch Lake, 2001 and 2002

	Yellow Perch	White Sucker	Rock Bass
Length			
Sample Size	7	11	2
Mean Fork Length (mm)	195	445	166
Minimum Fork Length (mm)	153	355	155
Maximum Fork Length (mm)	248	498	176
Weight			
Sample Size	4	11	1
Mean Weight (g)	61	1085	78
Minimum Weight (g)	36	660	78
Maximum Weight (g)	76	1500	78

Hoop Net



Appendix A: Specifications of Hoop Nets